

1550 nm EXTERNAL MODULATION

CATV OPTIC TRANSMITTER

USER MANUAL

DECLARATION

Our Company describes the manual of 1550nm external modulation transmitter 2X3 dBm roundly precisely & in latest edition. But we apprizes clients prudently that our company reserves the authority to adjust the relevant content in the file. We will not take the responsibility for the result from the mistake of recommended material, printing & tabling.

This manual states the shape, function, installation, network application and all the acceptable standard options of 1550nm External modulation CATV optic transmitter 2X3dBm. Includes following items:

- **SYSTEM INSTALLATION**
- **SYSTEM OPERATION**
- **SYSTEM DEBUGGING**
- **NETWORK DESIGN**
- **OPERATION PRINCIPLE**
- **FAULT DISPOSAL FLOW**
- **RETURN FOR REPAIR**

CONTENT

I. Product summary.....	4
1.1 Product summarize	4
1.2 Product specialty.....	4
1.3 Technique index	4
II. Installation	5
2.1 Goods receipt checking	5
2.2 Installation notice	5
2.2.1 <i>Safety factor</i>	5
2.2.2 <i>Static sensitivity specialty</i>	6
2.3 Installation preparation	6
2.3.1 <i>Environment condition</i>	6
2.3.2 <i>Power supply condition</i>	6
2.4 Equipment setting	7
2.5 Electric connection	7
2.6 RF connection	7
2.7 Optic connection	7
III. Operation	8
3.1 Front panel control & indicator	8
3.2 Rear panel connection	9
3.3 Boot-strap Sequence.....	9
3.4 Startup main menu	10

3.5 Startup sub menu	10
IV. (OMI) adjusting	10
4.1 Request for RF signal.....	10
4.2 Request for RF signal.....	10
4.3 AGC status	11
4.3.1 <i>AGC status setup</i>	11
4.3.2 <i>AGC status adjusting</i>	11
4.4 MGC status	11
4.4.1 <i>MGC status setup</i>	11
4.4.2 <i>MGC status adjusting</i>	12
V. Network design	12
5.1 SBS critical value 's choice	12
5.1.1 <i>The longest optic fiber distance of system transmission</i>	12
5.1.2 <i>Fiber input optic power</i>	12
5.2 Correct connection between TX & EDFA	13
5.3 Incorrect connection between TX & EDFA	13
5.4 SBS adjustment process	14
VI. Equipment working principle	14
VII. Fault disposal	15
7.1 Warning status	16
7.2 Alarm status	17
7.3 Fault precaution	17

7.4 Deflection restoration	17
7.5 Sensitivity degree to 980 nm laser	17
VIII. Guaranteed repair range for product	18
8.1 Guaranteed repair rule	18
8.2 Instruction for special product guarantee & repair	18
8.3 Compensation range	18

I. PRODUCT SUMMARY

1.1 Product summarize

1550nm External Modulation CATV transmitter 2X3dBm adopts low noise, narrow bandwidth, and continuous wave laser as its light source. It uses high linearity LiNbO₃ external modulator to modulate signal. It eliminates the Chirp Effect of 1550nm direct modulation laser. Due to adopting owned system optimized control technology & using top grade key parts, the machine's technique performance index achieves the standard of same advanced products in the world totally.

1.2 Product specialty

1. High index : Original system optimized control technology, offers excellent CNR, CTB, CSO & SBS index.
2. Flexibility : Original SBS critical value 13, 16, 18 adjustable at spot, it can fit for different network.
3. Reliability : Inside double power supplies, switch automatically. Machine case temperature control automatically.
4. High quality : Intuitionistic Optic Modulation Intensity (OMI) display.

1.3 Technical index

Performance			Index	Supplement
Optic feature	Wavelength range	(nm)	1555±5	ITU-TG.692 Standard wavelength
	Line width	(MHz)	≤1	FWHM($\Delta \lambda$)
	Side mode suppression ratio	(dB)	≥45	SMSR
	Equivalent noise intensity	(dB/Hz)	≤-160	RIN (20~1000MHz)
	Output power	(dBm)	2×3	Optional 2×5, 2×6, 2×9, 2×10
	Return loss	(dB)	≥50	
RF feature	Optical fiber connector		SC/APC	Optional LC/APC,FC/APC
	Work bandwidth	(MHz)	47-862	
	Input level	(dBmV)	18~28	AGC
	Flatness	(dB)	≤±0.75	45~862MHz
	Return loss	(dB)	>16	45~750MHz
	Input impedance	(Ω)	75	
Link feature	RF port		F-Female	
	Transmit channel		PAL-D/60CH	NTSC/80CH
	CNR1	(dB)	≥53	Back to back
	CNR2	(dB)	≥52	65Km optical fiber, 0dBm receive
	CTB	(dB)	≤-65	
	CSO	(dB)	≤-65	
General feature	SBS restrain	(dBm)	13, 16, 18	Adjustable
	Network interface port		RJ45, RS232	Support I.E. & SNMP
	Power supply	(V)	220VAC	-48VDC optional
	Power Consume	(W)	≤50	Single power works
	Work temp.	(°C)	-5~65	Machine temp. control automatically
	Storage temp.	(°C)	-40~85	
	Operating relative humidity	(%)	5~95	
Size			(")	19×14.5×1.75
				(W)x(D)x(H)

II. INSTALLATION

In installation equipment, please execute as following process. Every detail of installation will be described in this chapter. This chapter includes main contents as below.

- Checking the possible loss or damage of the equipment in transportation.
- Prepare the executive setting environment
- Setting 1550nm optic transmitter

- Electric connection
- RF signal connection
- Optic connection
- Network connection ports

2.1 Checking goods in receiving

Carefully open the packing to check the machine & parts. Please check the packing material of small parts also. Checking the objects as below items.

- 1550nm optic transmitter
- User operation manual
- Test datum of leaving factory
- Alternating power supply plug wire

If any item lost or damaged, please inform us immediately.

2.2 Installation notice

2.2.1 Safety factor

When install & use the products, please accord with all the relative safe measure of management & operation. If disobey below stated safety measure & special steps in the manual, it will damage the safe grade in product design, production & expected purpose. Our company will not take any responsibility for the result from user disobeying safety measure. Please notice the content with the below sign ; if ignore it, will bring damage to equipment & parts possibly.



WARNING

Don't operate it before you understanding & realizing all the conditions exactly!

2.2.2 Static sensitivity spatiality

Please obey static protection process and operate it.

Operating according to design request totally, the semi-conductor optic transmitter & receiver have high reliability performance. But, the static result from careless operating will damage the semi-conductor transmitter possibly.

Static can pass through the rear panel connector or front panel test ports into the semi-conductor transmitter. When opening or operating the transmitter, please accord with Static Protection Procedure, including using grounding metal wrist belt, grounding worktop & grounding conductor.

If place the optic transmitter on the ground, the static charge will mostly decreased.

2.3 Installation preparation

2.3.1 Environment conditions

According to the design request, 1550nm optic transmitter can work under 0°C ~ 50°C (32°F ~ 122°F) temperature range. We recommend 25°C (77°F) environment temperature.

Humidity not bigger than 95 % (under non-coagulation condition) . If necessary, the equipment should keep the suitable temperature & humidity in the restrained scope. We recommend to operating in the environment without dust.

2.3.2 Power supply condition

Equipment powered by AC or steady voltage DC. In both of AC & DC, AC is the chief power supply.

Request of power supply:

AC input	94-245 VAC , 50-60 Hz
DC input	36-60 VDC , floating
Power consumption	Maximum 50 W

The DC power supply of the equipment must be the SELV supply stipulated as CAN/CSA C22.2 No.950-95 standard.

2.4 Equipment setting

1550nm optic transmitter adopts 1U high , Standard 19" casing. We suggest to keeping 1.75-inch (about 4.5cm) space on the top & bottom of the machine, to ensure the ventilation & heat dispersion.

2.5 Electric connection

- (1) The machine should have good grounding, grounding resistance < 4Ω. According to the international standard, 220V plug in adopts tri-wire rule, the middle wire is the grounding wire.
- (2) The machine adopts high performance, high reliability, steady voltage switch power supply, it has isobaric ally overflow protection. It can work in 110~254 VAC electric network. The micro processor are monitoring the output DC voltage. If the Fuse is melted broken, it shows the machine's inner parts has occurred problems.

WARNING

Before connecting circuit, please use big spec (#20AWG and more) electric wire to connect the grounding screw on the bottom and the grounding frame. When use DC input power supply, the equipment chassis must be grounding.

2.6 RF connection

Connect the RF cable & the connector on TX rear panel. RF connector is F type plug. The equipment uses Britain System. The resistance is 75Ω .

2.7 Optic connection

Considering for protection & safety, all the fiber optic connector need protect cover in transportation.

Don't take away the protect cover before setting.

In order to ensure the insertion loss & return loss, the end-face of fiber optic connector is polished extremely. Please don't dirt the pollute the connector. Even very micro dust will also affect the transmission quality. When off the fiber optic connector, please put on the protection cover.

To keep the cleaning of fiber optic connector in connection or re-connecting is very important.

Without proper maintain job, fiber optic transmission system will not realize the function very perfectly. The system function will be decreased as below forms

- Analog signal transmitting quality turns bad
- Digital signal wrong data rate will increase
- Optic power will be decreased.
- Optic receiver's receipt optic power cannot reach the best range.
- Dusty fiber optic connector will pollute other connected optic parts.

Recommended RIFOCS Co., Ltd 's 945/946 fiber optic cleaning system to clean the connectors. For the covered optic fiber connector, please discharge the rear panel then pull out the inner optic jumper and clean it.

WARNING

Cleaning all the fiber optic connectors before setting.

Connect the output fiber optic jumper into the proper input connector socket of EDFA. The connector type is FC/APC, E-2000, pigtail or SC/APC optional.

III. OPERATION

3.1 Front panel control & indicator

1. Laser key switch Laser source On/Off switch (Press to ON)
2. Status indicator LCD ①LASER Laser status
- ②RF RF status
- ③FAN System temperature
- ④POWER Power status
3. VFD display Double line VFD display each parameter & warning
4. Choose button △, ▽ Up/down/choice button
5. Status Choose main menu and set up working status & parameter
6. OMI modulation coefficient indicator Indicate present OMI index
 No RF input, 20 lamps all not turn on
 2 pcs green lamps on (in 20 pcs lamps) indicates OMI suitable
 (as original status of leaving factory)
7. AGC status indicator This lamp on, it is in AGC status
8. MGC status indicator This lamp on, it is in MGC status.
9. OMI adjusting This function for user application
-

In AGC status, OMI value adjustable slightly

① **Key switch**
Accord with IEC safety standard ;
Protect radiation to the user's bare skin..

③ Display

Layered menu, controlled by front buttons. Monitor & control the selected parameter.

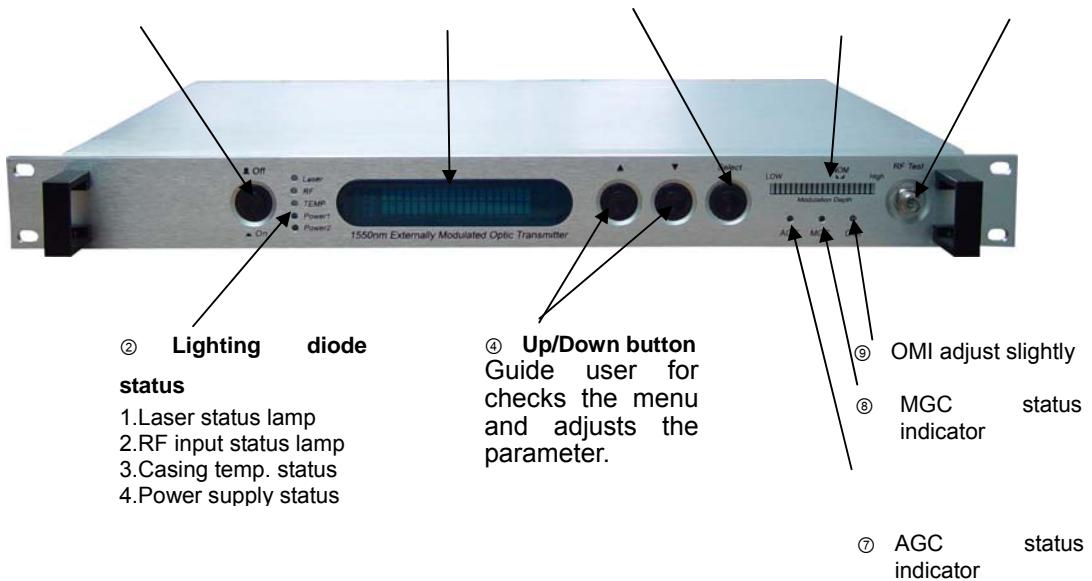
⑤ Select

Select one item from the menu to observe and adjust it.

Modulation Depth Indicator

⑩ RF test port
For inspect of input signal

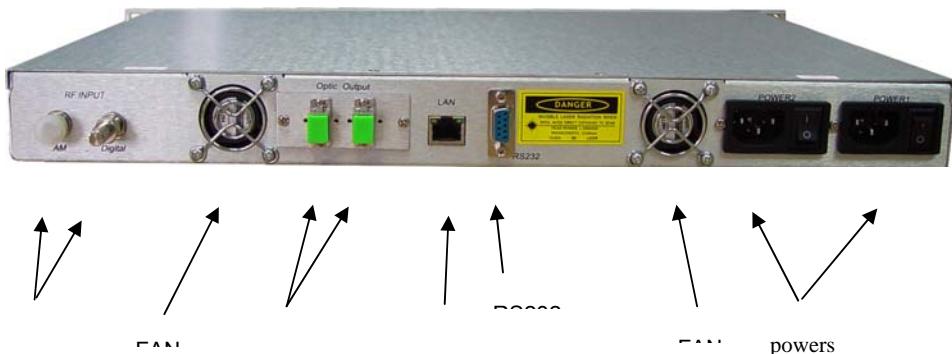
In MGC status, OMI value adjustable



3.2 Rear panel connection

Power supply input module consists of “On/Off”switch , adopts 3-pin IEC AC plug-in.

Notice: Before turn on the power supply in rear panel, please confirm the key switch of front panel is on the ‘Off’ position. Rear panel image:



3.3 Boot-strap sequence

- Plug in 220V city power supply
- Turn on power switch in the rear panel

Front panel display “ KEY OFF”

Laser Status lamp Red

RF Status lamp Red

FAN Status lamp Green

POWER Status lamp Green

C、 Press laser start-up key switch

Front panel shows “**KEY ON.....**”, Laser status lamp turns green from red, machine enters self-checking, after checking it enters working status, display “**Welcome to.....**”

3.4 Start-up main menu

Press Status button will display below main menu in sequence.

- | | |
|--------------------|---------------------------------|
| A、 Descriptor | Equipment model |
| B、 Optic Menu | Optic status menu |
| C、 OMI Level Menu | Optic modulation intensity menu |
| D、 Laser Menu | Laser status menu |
| E、 SBS Menu | SBS restrain status menu |
| F、 Modulation Menu | External modulator status menu |
| G、 Stem Menu | System parameter menu |

3.5 Start-up submenu

Press Δ 、 ∇ button will display submenu.

When screen displays submenu, press “Status” will not work any longer.

IV. OPTIC MODULATION INTENSITY (OMI) ADJUSTING

4.1 Request to RF signal

Input gain : AGC status 78dB μ V ~ 88dB μ V

MGC status 75dB μ V ~ 85dB μ V

Bandwidth : 45 ~ 862MHz

Flatness degree : ± 0.75 dB (45 ~ 862MHz)

Resistance : 75Ω

4.2 Description of OMI

- A、 When the machine leaves factory , the default OMI is set on AGC status.
- B、 The machine has Build-in software, after switching off, it will keep the earlier OMI status and OMI set.
- C、 The OMI is setup on the best status when leaving factory, “Modulation Depth” modulation coefficient status indicator will be on NOM position , (two green lamps turning on), referring to the Modulation Depth when under full channels loading, TX to RX, system CNR ≥53Db.
- D、 The position of Modulation Depth modulation coefficient status indicator lamp is determined by the needed Modulation Depth, if it is in NOM position has nothing to do with any default of the whole unit.
- E、 Increasing OMI value, CNR will be up , but CTB、 CSO value will be down. On the contrary, decreasing OMI value, CNR be down, CTB、 CSO value will be up.
- F、 If not necessary, please don't adjust OMI value.

4.3 AGC status

4.3.1 Set AGC status

- A、 Press Status button, display OMI Level Menu main menu
- B、 Press △、▽button, check current OMI status
 - If display RF Mode=AGC, then the unit is under AGC status
 - If display RF Mode=MGC, then the unit is under MGC status
- C、 Press Status button, display RF MODEL=
- D、 Press △ button to confirm, RF Mode=AGC
 - AGC set is completed

4.3.2 OMI adjustment under AGC status

Press Status button, display OMI Level Menu main menu

Press Δ 、 ∇ button, display OMI ADJ= $\pm x.xx$

Press Status button, display OMI ADJ=.

Press Δ 、 ∇ button, 0.3 dB step length, choose the proper value, such as OMI ADJ= +3.5dB.

Press Status Button, and confirm the OMI value.

4.4 MGC status

4.4.1 Set MGC status

A、Press Status button, display OMI Level Menu main menu

B、Press Δ 、 ∇ button, display RF Mode=AGC sub-menu

C、Press Status button, display RF MODEL=

D、Press Δ button to confirm, RF Mode=manual

MGC set is completed

4.4.2 MGC status adjustment

Confirm RF Mode=MGC

Use slim “—“ type screwdriver into OMI adjusting hole, adjusting OMI, make Modulation Depth (modulation coefficient indication) to NOM position, namely two green lamps turning on, this time, RF status will turn from red into green.

The adjusted result should let CNR, CTB, CSO accord with system index.

V. NETWORK DESIGN

1550nm system can use EDFA to extend transmission distance, when signal is operated in 1550nm, the fiber should be considered of some factors, such as Chromatic Dispersion, SBS, SPM (Self Phase Modulation) and other non-linearity effect of optic fiber. The network we designed for you has supplied some simple rules of using the transmitter.

5.1 The choice of SBS critical value

5.1.1 The longest optic fiber distance in system transmission

If you want to transmit more than 100km, you need to select 13dBm SBS restrain status. Why you need to do this is because of SPM & optic fiber Chromatic Dispersion. If bandwidth-extending status is not changed, when fiber length is longer, CSO performance will be worse. If you want to choose

longer distance transmission, you need to select smaller line bandwidth. 13dBm is much smaller, 16dBm is much bigger, and 18dBm is the biggest. The following table shows the recommended fiber length in which SBS restraint status.

Optic Fiber Length	SBS Restrain Condition
< 60Km	13dBm, 16dBm, 18dBm
< 70Km	13dBm, 16dBm
< 120Km	13dBm
> 120Km	13dBm (CSO performance will be some different from the specification possibly)

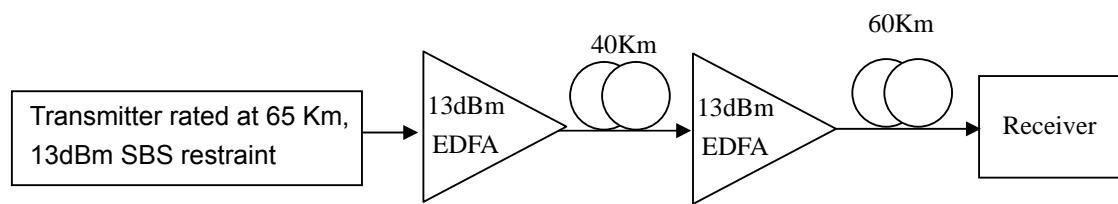
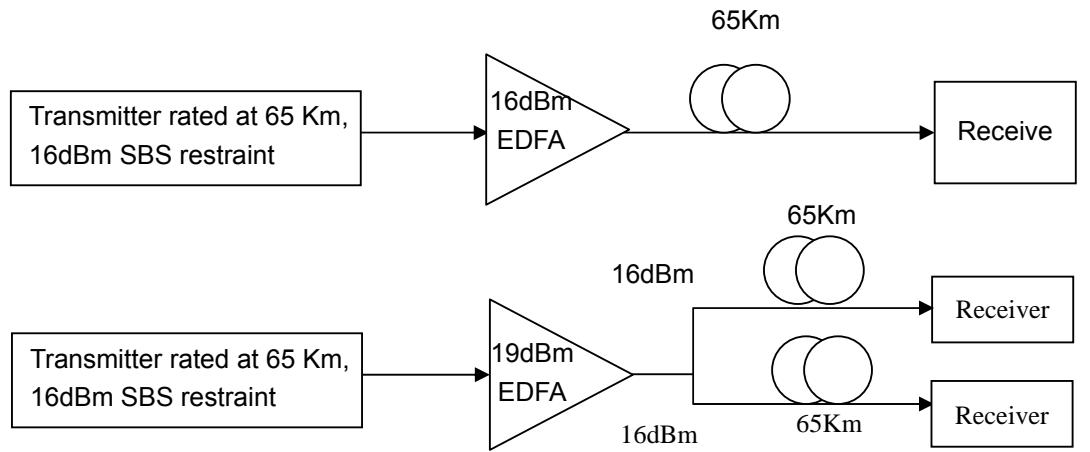
5.1.2

The biggest optic fiber Input power is restricted by SBS restraint status. If your power is bigger than the stipulated limit, it will occur some bad result. The low frequency band will have 1/f noise, low channel's CNR will not be good, HUM will also be worse than in normal status. The attached table shows the limit value of SBS restraint power.

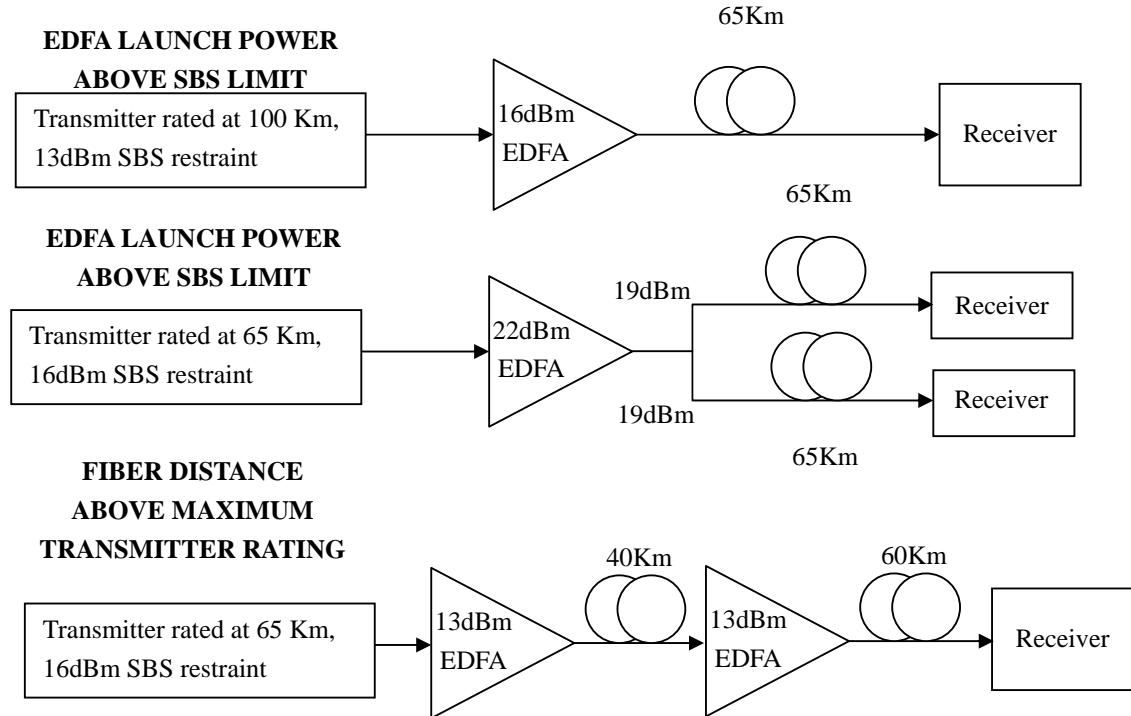
SBS restraint power	Limit of optic fiber input power
18dBm	Max.18.4dBm
16dBm	Max.16.4dBm
13dBm	Max.13.4dBm

The general CATV operator will use high power EDFA (such as 22dBm and higher one), and use optic splitter to arrange the power transmitting in the optic fiber & cable. It is no problem to do this, because the optic fiber patch cord is short. But it is necessary to notice that SBS restraint setup rest with the worse situation, for example, the longest distance & the biggest fiber input power in the optic cable.

5.2 The correct link for transmitter & EDFA



5.3 Incorrect link for transmitter & EDFA



5.4 SBS adjustment process

1550nm External modulation transmitter 2X3dBm offers special technology. It can let user adjust the SBS critical value at the spot. The default SBS restraint value is 16.5dBm when leaving factory. The user can adjust it by himself. The adjustment process according to the real requirement of system:

A : Use STATUS button, select “SBS Menu” main menu ;

B : Use $\Delta\downarrow$ button, select “ SBS=16.5” submenu ;

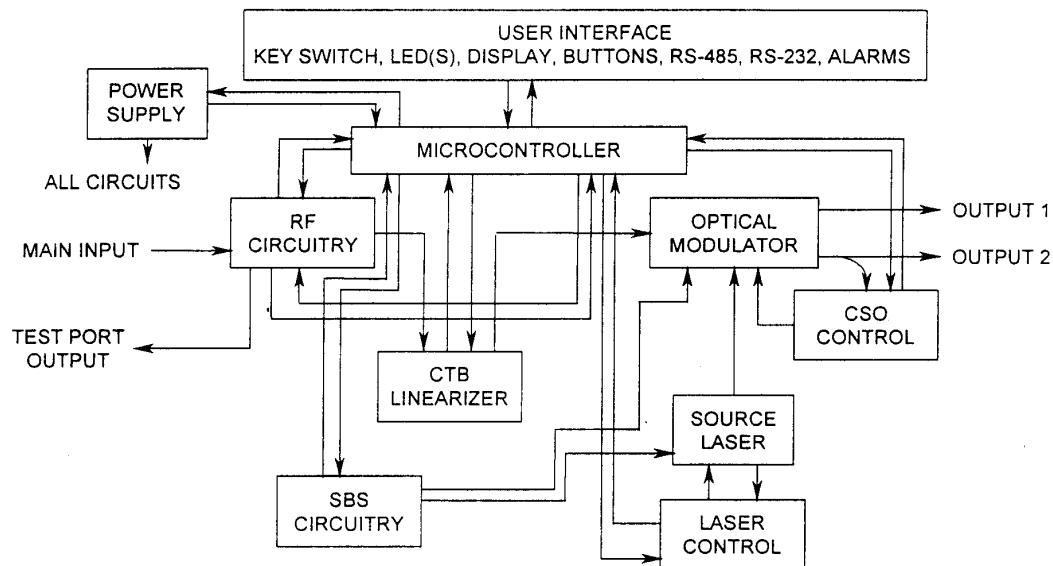
C : Press STATUS button, enter to opening “SBS” select software ;

D : Use $\Delta\downarrow$ button , select the SBS critical value what you need ;

E: Press STATUS button again for confirmation.

VI. EQUIPMENT OPERATION PRINCIPLE

1550 nm optic transmitter principle frame as picture 18 stated. Input RF signal is verified at AGC circuit unit and affect on optic modulator to modulate the CW light, which is output from 1550nm laser module. The small part output light is checked partly, then feedback to modulator circuit to control the



modulation gain & modulation distortion gain.

Picture 18. 1550 nm optic transmitter operation principle frame

The non-linearity of optic modulator is inherent. If there is no compensation, the distortion & intercrossing modulation of modulator will let the signal cannot be applied. Generally, the inherent distortion can be modified by adding DC deflected voltage on modulator crystal. For one more modification, you can monitor the inter-modulation result of two low gain test signals, then adjust the DC deflected voltage of modulator to decrease the distortion into the smallest value. These process is in continuous execution under the closed loop control of system control microprocessor . It is clear to user.

Microprocessor monitors the deflected gain for eliminating the distortion, and sending relative warning. If any gain is close to the margin of control system, or the control system can not sustain the deflection on the necessary gain, it will sending out warning.

The laser is placed on the Thermo-Electric Cooler (TEC) directly. Temperature control circuit drives TEC working to control the working temperature of the laser , and prevent the performance decreasing or damage result from overheated laser. The microprocessor monitors the temperature of laser & controls the TEC current. If TEC current exceeds the pre-established standard range or is close to the margin of control ability, the system will send out warning.

Setup the temperature warning can let the TX sustain the longest running time under the common aging speed of the laser. And repair or replace the laser when it is necessary before the parts can not be repaired.

VII. FAULT DISPOSAL

1550nm optic transmitter can monitor system operation and offer brief note of warning. It can correct the majority status deflection of the equipment, such as : system parameter floating, equipment tolerance, laser aging, RF gain changing, temperature changing. The TX will go on working when it is sending out warning. The facility is self-detected continually and relative system parameter will recover into normal range, then the warning will disappear. Some serious warning can be eliminated by restart the power supply of the equipment. If some relative parameter recover to normal range, the warning will disappear automatically.

The majority warnings will be sent out when the correction ability is close to or exceed the permitted range. At most of these situation, user can not modify these status. Status modification needs special equipment & available facility. The modification only could be processed in the factory.

7.1 Warning status

When TX is on warning status, the status LED will turn red and the brief note of status will be displayed on the screen. The warning will not stop the TX running, it only shows the relative parameter exceeding to normal scope slightly. If the warning is stopped, it shows the relative parameter is returned into permitted scope. The screen & diode will return into their normal status and no need to interfere by user. But to be emphasized is that the problem of warning can not be ignored. It is possible of some serious system fault potentially.

TX work status	Status display	LED color	Explanation
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Present laser deflection is low	Warning: Lsr Bias Low	Red	Predicts the deflected circuit fault or laser aging. The TX needs repair.
Present laser deflection is high	Warning: Lsr Bias Hi	Red	Predicts the deflected circuit fault or laser aging. The TX needs repair.
Laser temp. is high	Warning: Laser Temp Hi	Red	Laser temperature is floated from 25°C. Check the room temperature, whether it is still in requested range. Continue monitoring.
Laser output power is locked	Warning: Lsr Pwr Lock	Red	Laser output power is floated from correct value. But the circuit is locked. Please continue monitoring.
Laser temp. is locked	Warning: Lsr Temp Lock	Red	Laser temp. control loop fault. Check the room temperature, whether it is still in requested range. Continue monitoring.
TX environment temp. is low	Warning: Itemp(12) Lo	Red	Optic TX environment temp. was floated from 25°C. Monitoring it till warning disappears.
TX environment temp. is high	Warning: Itemp(12) Hi	Red	Optic TX environment temp. was floated from 25°C. Monitoring it till warning disappears.
Modulator deflected	Warning: Modulator Bias	Red	Modulator deflection point is close to maximum. Continue monitoring. Deflection maybe need reset.
Modulator deflection floating	Warning: Mod. Drift Hi	Red	Modulator deflection point is close to maximum. Continue monitoring. Deflection maybe need reset.
TX inner temp. is high (1)	Warning: Itemp(L)	Red	TX inner environment temp. is close to limitation. Check the surrounding temperature and continue monitoring.
TX inner temp. is high (2)	Warning: Code #13c	Red	TX inner environment temp. is close to limitation. Check the surrounding temperature and continue monitoring.
TX interface board temp. is low	Warning: Amb temp low	Red	TX inner panel temp. is close to limitation. Check the surrounding temperature and continue monitoring.
TX interface board temp. is high	Warning: Amb temp high	Red	TX inner panel temp. is close to limitation. Check the surrounding temperature and continue monitoring.
RF input gain is low	Warning: RF Input Low	Red	RF input gain is close to minimum value of AGC. Check the input gain & route. Continue monitoring.
RF input gain is high	Warning: RF Input Hi	Red	RF input gain is close to maximum value of AGC. Check the input gain & route. Continue monitoring.
AGC circuit is not locked	Warning: AGC Not Locked	Red	RF input gain is close to margin. Adjust the input gain to eliminate the warning. If the warning is still existed. The TX needs repair.
Fan fault	Warning: Fan Failure	Red	TX rear fan parts is faulty. TX needs repair.
Modulator drive gain is low	Warning: OMI Low	Red	The RF drive power entering modulator is low. CNR performance can be improved by increasing OMI.
Modulator drive gain is high	Warning: OMI Hi	Red	The RF drive power entering modulator is high. Distortion performance can be improved by decreasing OMI.

Picture16. Warning information

7.2 Alarm status

When the TX send out warning, it is stopped working generally. The alarm is because of some relative parameter exceeding its safety working scope or some situation causes damage to the laser. Some alarm could be eliminated by restart the power supply or reset the key switch. For some alarm

couldn't be eliminated by user, please contact our company immediately.

7.3 Fault prevention

User can notice below information to prevent some potential problems.

1. Please place the transmitter under environment temperature 0°C~50°C, other conditions accords with requested running range. We suggest to place the TX in low dust environment.
2. Ensure the rear panel fan & front panel sockets in ventilation , let the rear panel fans running.
3. Check the power supply whether works in stipulated standard scope. And check all the joints are correct.
4. Check the changing of RF gain , control it in the permitted range.
5. Keep the optic fiber connector clean & joint properly. Prevent output optic power decreasing result from optic leakage.

7.4 Deflection restoration

Due to parameter floating result from modulator long time working, it causes the modulator deflected voltage warning. Usually, it can be solved through resetting its deflection, namely turn the key switch into " OFF", then turn it into " ON". Restoration process needn't further input operation, but it will spend around 45 minutes to make the control loop return to stable status. In this term, the CSO will be a little bad, the output signal will come down and floating will be smaller. Deflection restoration should be worked when it is not on line or the situation of signal quality decreasing is accepted. The floating process is very slowly, therefore, it needs enough repair time to eliminate the warning.

If the warning still can not be eliminated, please contact us promptly.

7.5 The sensitivity to 980nm laser

When connecting 1550nm EM transmitter & EDFA, please specially notice the influence of the reflect light to the optic transmitter , which is coming from 980nm Pump Laser of EDFA. 980nm Pump Laser can reflect to the optic output port of the transmitter. The extra optic power enters the input port of transmitter will affect the deflection point of CSO loop. And it will make the loop unstable under the extreme situation. In this situation, the CSO fault will be displayed on any monitor warning joints & front screen.

In order to prevent this situation, please use the EDFA with optic isolator. Similarly, the TX output light also exists reflection or un-matching to the optic connector. Generally, the reflect light of entering optic TX output port can not exceed -25dBm. It is better if the reflect will be weaker.

VIII. GUARANTEED REPAIR RANGE FOR PRODUCT

Our quality guaranty system includes equipment test & inspection to operation process. It ensures the reliability of product quality.

Before product leaving factory, we have adopted any possible measures to keep each index of the electrics, optics & mechanism achieving the standard. We request all the user to inspect the checking

& assembling; the test person must operate the machine according to the stipulated prevent measure , when they are operating & testing those optic static sensitive parts.

8.1 Guaranty rule

We offer one year guaranty to the material & technique of our products. And respond for repair the product free charge in one year.

When use the product, please obey with all the regulation in the manual. Don't change it freely. In the guaranty term, any user can not open the machine & change the inner circuit. If the product quality has not reached the request & needs repair, please return the products to our company. Our company will process it according to the rules.

In guaranty term, user has authority to decide either repair or replace the faulty product. But above stipulation is invalid to changing belonging or the faults result from incorrect using, storage, transportation & assembling and other accidents.

8.2 Special product guaranty & repair guide

All the products are produced according to high quality standard and ensure escaping faults on technical , material and out frame. If user wants to repair or replace faulty products, please put forward it in 30days after receipt or in quality guaranty term.

If you need replace the products, which is not matching the quality standard, please accord with below principle.

- a. Please send back the products after receiving the Callback Bill from us. Please attach the model number, serial number & causes when you apply for withdrawing the product.
- b. Before repair, we will inform user about the test result and repair charges (under some problem of incorrect application and not suitable for guaranty.) When we receiving the confirmation from the user, then we go to repair the machine.
- c. The product after repair has the same quality guaranty term. It has guaranty treatment 90 days after receiving the goods.

8.3 Compensation range

If the products meet below problem, we will compensate for the customer. We disobey the order , contact and other stipulation on the contract; Damage because of design , sales, transportation, safety check, assembling, inspection & operating according to the manual. The compensated amount can not exceed the damaged product ' price or the amount in the contract.

We have not promised for some protocol for product, parts & A-S service except the guaranty in the document. We have no responsibility for the behavior as below & the damage result from incorrect assembling, parts or application.

User discharges or puts IC, inner connect wire, and does coupling or connecting on the fiber. These behaviors will damage the facility or affect the output. For above reason causing performance worse in equipment or fiber optic output signal, our company has no responsibility.

The average invalid time, average fault interval & other reliability data in our test report & datum are

only used as reference for design. It doesn't mean that other samples or products have to be the same effect. These datum could be one gist for management and project design, but in real application, it needn't achieve the same effect. These datum are as one standard of ideal design & perfect parts. The making process will not affect the reliability.

We can repair our products, which are exceeding guaranty term. The user needs to pay the material charge.